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BWA

The Record 5200

Stanley W. Meso April 12, 1967

Forest Insect Control (Balsam Woolly Aphid
Trend Plot Study, Crater Lake N.P.)

The three balsam woolly aphid trend plots established at Crater Lake National Park were examined during September 1966. This inspection was made with the help of Dr. Russel Mitchell, Entomologist, PNW Station, who instructed Park Rangers Marvin Herchel, Larry Hakel, and me to identify balsam woolly aphid infestation signs.

Copeland Creek, the northernmost plot in Larry Hakel's District, was examined September 20. Larry was shown damage this aphid was doing in and adjacent to the trend plot. Objectives for this study were outlined while he helped me with the data recording. We found only two recently dead trees. On September 21 the Trappers Creek plot was inspected with the help of Marvin Herchel. Here the infestation trend was outlined for him. No new mortality was found but more damage such as faded foliage and gouted branches was much more apparent. Red Blanket Creek plot was examined September 22. This plot is also on Marvin Herchel's District, and he was shown its location. No aphid infestation signs could be found.

The Park offers an excellent opportunity for observing effects balsam woolly aphid has on two associated fir species. Two purposes for establishing these plots were to determine whether Shasta red fir, Abies magnifica and/or A. magnifica shastensis, is susceptible to aphid damage, and to find out how long infested subalpine fir, A. lasiocarpa, can sustain aphid populations before total tree mortality occurs.

Branch gouting

When the plots were inspected in 1966, not only were recently dead trees counted, but branch gouting intensities were also recorded. Gouting, a reaction of the branch tissues to the toxic aphid saliva, does not usually cause tree mortality. Tree death results from aphid-killed tissue along the main stem. Gouting is used as an indicator of aphid population density. Aphid feeding begins at the crown top and progresses downward. When population density is high and feeding intensity heavy, the crown will

disintegrate and die in stages. These discolored dying branches indicate the presence of aphid infestations. When this is detected, aphid populations are well established and tree mortality certain.

Binoculars were used to evaluate each tree for gouting percent. Dr. Mitchell suggested the following classification:

Class 1 - 1 to 33 percent of crown branches gouted,
Class 2 - 33 to 66 percent of crown branches gouted
Class 3 - 66 to entire crown gouted.

Table 1 summarizes numbers of trees in each gouting classification by crown class for each fir species at two trend plots. No gouting was found at Red Blanket Creek.

Table 1.--Balsam woolly aphid gouting intensities at two trend plots by fir species and crown class - 1966

Plot and Gouting Class	Crown Class: Dominant: sub alp	Dominant: red fir	Co-dominant: sub alp	Co-dominant: red fir	Intermediate: sub alp	Intermediate: red fir	Suppressed: sub alp	Suppressed: red fir	Total
	------ Number ------								
Copeland Creek									
Class 1	0	11	2	8	2	1	--	--	24
Class 2	1	2	10	4	8	2	--	--	27
Class 3	3	--	3	--	8	1	1	1	17
All trees	4	13	15	12	18	4	1	1	68
Trappers Creek									
Class 1	8	9	6	1	6	3	2	--	35
Class 2	4	4	1	2	3	6	--	--	20
Class 3	2	--	1	--	2	2	--	--	7
All trees	14	13	8	3	11	11	2	--	62

Branch gouting is confined to the co-dominant and intermediate trees at Copeland Creek (table 1). This stand is composed mainly of these two crown classes (table 2). The number of red fir gouted in the co-dominant class is almost similar to subalpine fir, but gouting intensity is not as severe. A larger number of dominant Shasta red fir is gouted, but again intensity is light. Gouting on Shasta red fir has been reported to stop when aphid populations on surrounding subalpine firs have died.1/ Subalpine fir heavily gouted in the dominant, co-dominant, and intermediate crown classes supports discolored foliage. Some of these trees are expected to die in 1967.

The number of trees gouted at Trappers Creek is nearly the same as Copeland Creek. More trees were found gouted in the dominant and intermediate crown classes. This damage follows stand composition where these two crown classes make up the plot majority (table 3). Dominant tree numbers in each gouting class are nearly the same. The two dominant subalpine firs in Class 3 gouting is half faded, and mortality might occur in 1967. There are no clear indications that further mortality will occur in the intermediate or suppressed trees.

No damage could be found at the Red Blanket tree plot. Russ Mitchell recorded some light gouting at his plot about a mile southeast of this site, but none could be detected at this plot.

Tree mortality

One hundred trees were tagged for observation at each plot in 1964. The following tables summarize tree mortality by crown class and fir species since they were tagged for observation.

Copeland Creek Plot--This plot is due west of Crater Lake and situated in fir stands that have supported aphid damage for several years (see attached map). This stand is dense, on a slope, and soil moisture is high along the plot margins. When this plot was established, 62 percent of the trees were subalpine fir while Shasta red fir comprised the remaining 38 percent. Stand composition is changing and this change is summarized in the following table.

1/ R. G. Mitchell, 1966, Infestation characteristics of the Balsam Woolly Aphid in the Pacific Northwest, p. 11, U.S. Forest Service. Pac. N.W. For. and Range Expt. Sta. Rec. Paper PNW-35, 18pp.

Number of trees living in the years 1964 - 1966

Table 2.--Mortality caused by balsam woolly aphid by crown class and fir species at Copeland Creek, 1964-66

Year	Crown Class				
	Dominant	Co-dominant	Intermediate	Suppressed	Total
			Number		
1964					
Subalpine fir	5	28	26	3	62
Shasta red fir	19	15	4	--	38
All trees	24	43	30	3	100
1965					
Subalpine fir	5	20	18	1	44
Shasta red fir	19	15	4	--	38
All trees	24	35	22	1	82
1966					
Subalpine fir	5	18	18	1	42
Shasta red fir	19	15	4	--	38
All trees	24	33	22	1	80

Mortality at Copeland Creek continues but at a reduced rate. Table 2 shows that only two co-dominant subalpine firs died in 1966 as compared to eight in 1965. Eight intermediate trees died in 1965, but none were found in 1966. Twenty percent of the stand, all subalpine fir, has died since this plot was established. No Shasta red fir mortality was found or was there any foliage discoloration.

Trappers Creek plot--This plot is situated southeast of the main balsam woolly aphid infestation areas (see attached map). This stand is dense, on moderate slope, and along an intermittent stream. Stand composition is quite similar to the Copeland Creek plot. Subalpine fir comprises 64 percent of the plot while 36 percent is Shasta red fir. No aphid damage on or adjacent to this plot has been detected from the air. Foliage fading

is beginning to occur in the lower branches of scattered subalpine and Shasta red fir within the plot area. This fading is expected to be hidden from aerial view by the overstory. Cause of this branch mortality has not been definitely established in Shasta red fir. Those trees that have faded branches support no gouting or at the very most Class 1 gouting. This species' intolerance to competition when older could account for some fading. Table 3 outlines the stand change since 1964.

No. of trees living in the years 1964-66

Table 3.--Mortality caused by balsam woolly aphid by crown class and fir species at Trappers Creek, 1964-66

Year	Crown Class				
	Dominant	Co-dominant	Intermediate	Suppressed	Total
	Number				
1964					
Subalpine fir	21	16	21	6	64
Shasta red fir	17	4	14	1	36
All trees	38	20	35	7	100
1965					
Subalpine fir	18	15	20	6	59
Shasta red fir	17	4	14	1	36
All trees	35	19	34	7	95
1966					
Subalpine fir	18	15	20	6	59
Shasta red fir	17	4	14	1	36
All trees	35	19	34	7	95

No subalpine or Shasta red fir mortality was found at Trappers Creek in 1966. Five percent mortality took place in 1965, again all subalpine fir (table 3). Three dominant trees died, one co-dominant, and one suppressed.

In 1965 two co-dominants were listed as dead, but a closer look in 1966 revealed that one still supported some green foliage in the lower crown.

The tally was corrected, but this tree is expected to die in 1967. Further selective alpine fir mortality is also expected to occur in 1967.

Red Blanket Creek--This southernmost plot is far removed from the older infestation centers. The trees are scattered on a well-drained, level site. No mortality or gouting signs were found in 1966. However, 10 miles southwest of this area a newly detected balsam woolly aphid infestation was detected along Red Blanket Creek (see attached map). How long it will take this infestation to reach the trend plot is supposition at this time. Gouting in stands about one mile southeast of this plot could influence aphid invasion, providing aphids causing this detectable gouting are still living.

Table 4.--Stand Composition at Red Blanket Creek, 1964-66

Year	Crown Class				
	Dominant	Co-dominant	Intermediate	Suppressed	Total
	Number				
1964-66					
Subalpine fir	7	12	10	--	29
Shasta red fir	22	30	19	--	71
All trees	29	42	29	--	100

Stand composition within this plot continues the same. Table 4 shows that Shasta red fir is the major fir species. Tree height here is generally shorter than on the other trend plots, and the stand is more open. This plot is very interesting, because not only is aphid activity lacking, but also stand conditions such as density and composition differ markedly from the other plots. These conditions could greatly influence stand susceptibility and infestation intensity.

Balsam woolly aphids have killed 20 percent of the trees at Copeland Creek plot and 5 percent at Trappers Creek since trees were tagged for study in 1964. No tree mortality or damage was found at the Red Blanket Creek plot close to the southern Park boundary. Damaged trees have been discovered near this boundary, but how long it will be before an active aphid population reaches the trend plot cannot be accurately predicted.

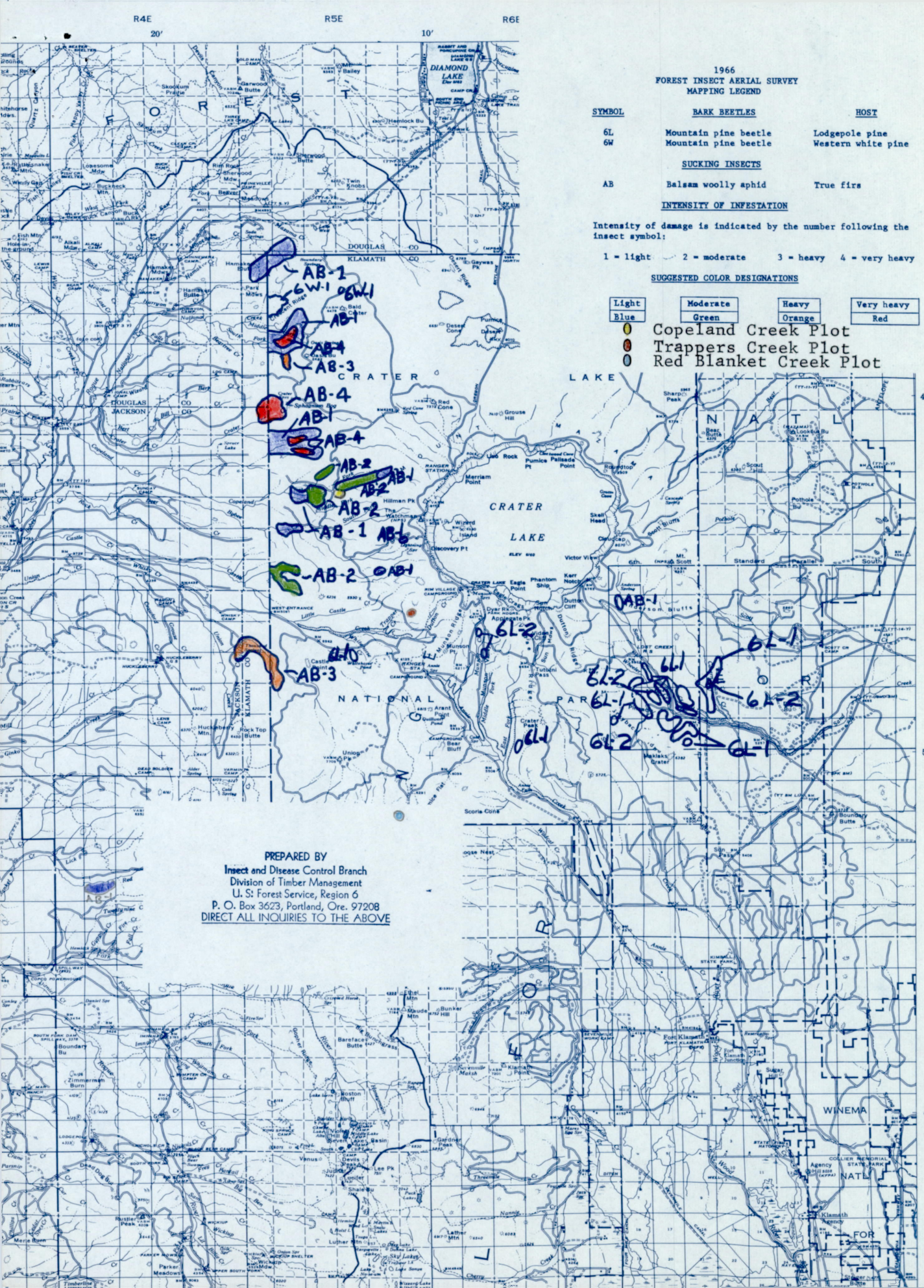
The effect balsam woolly aphid has on subalpine fir is substantiated, but

their effect on Shasta red fir is still not too clearly established. It has been reported that Shasta red fir can survive aphid feeding, but the conditions under which these survivals occurred have not been fully analyzed. Soil moisture, stand density, and crown competition at Copeland and Trappers Creeks would influance Shasta red fir recovery, while stand environmental conditions at Red Blanket Creek could delay an aphid invasion.

Stanley W. Meso

Attachment (Map)

cc: Crater Lake NP
John M. Mahoney, NPS
Rogue River NF
Russel G. Mitchell, PNW ✓
R-5


1966
FOREST INSECT AERIAL SURVEY
MAPPING LEGEND
SYMBOL
BARK BEETLES
HOST
6L
Mountain pine beetle
Lodgepole pine
6W
Mountain pine beetle
Western white pine
SUCKING INSECTS
AB
Balsam woolly aphid
True firs
INTENSITY OF INFESTATION
Intensity of damage is indicated by the number following the insect symbol:
1 = light
2 = moderate
3 = heavy
4 = very heavy
SUGGESTED COLOR DESIGNATIONS
Light Blue
Moderate Green
Heavy Orange
Very heavy Red
Copeland Creek Plot
Trappers Creek Plot
Red Blanket Creek Plot
PREPARED BY
Insect and Disease Control Branch
Division of Timber Management
U. S. Forest Service, Region 6
P. O. Box 3623, Portland, Ore. 97208
DIRECT ALL INQUIRIES TO THE ABOVE
R4E
R5E
R6E
T30S
T31S
T32S
T33S
T34S
CRATER LAKE NATIONAL PARK
DIAMOND LAKE
KLAMATH
DOUGLAS
JACKSON
WINEMA